REMARKS

The Office Action dated August 31, 2009 has been received and its contents carefully noted. From the Summary page, claims 1-28 were pending. Claims 6-13 have subsequently been withdrawn from consideration as being drawn to a non-elected invention. Claims 1-5 and 14-28 were rejected.

By this response, Applicants have amended independent claim 1 by substituting 28 wt % for the upper Niobium threshold value (support is found in Figures 4A, 6, 7, and 10, Examples 2 and 3, Table 2), canceled claims 2-4, 6-20 and 22-28 and have added claims 29-31 (support for the more narrow ranges exist in Table 2 and paragraph [0009]). Applicants reserve the right to file continuations (including divisional application) directed to the cancelled subject matter. Accordingly, claims 1, 5 and 29-31 are before the Examiner for consideration.

Claim Rejections - 35 U.S.C. §§ 103(a)

Claims 1-5, 11-23, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito et al. (U.S. 6,607,693) or over Hwang et al. (PG Pub. No. 2005/0072496). Applicants respectfully traverse.

Claims 2-4, 11-20, 22-23, 27 and 28 have been canceled, thereby mooting their rejection

The alloys of the invention were developed by depressing both the brittle omega phase and alpha double prime martensite by additions of neutral elements such as Zr and Sn and low amounts of beta stabilizer Nb ranges from 20 and 30 wt %.[1] The claims are clearly directed to these alloys.

[1] Applicants' findings of the elastic deformation mechanisms in Ti2448 alloy (Ti-24Nb-4Zr-8Sn) were published in Physical Review Letters, Vol. 98, 216405, 2007 and Vol. 102, 045503, 2009.

Claim 1 specifies a ternary alloy of Ti/Nb/Zr, a quaternary alloy of Ti/Nb/Zr/Sn or Ti/Nb/Zr/Al, or a quinary alloy of Ti/Nb/Zr/Sn/Al. As currently amended, claim 1 requires at least the following relative amounts: 28 wt % >niobium≥ 20 wt%, and 2~15 wt % zirconium. The claimed alloys are directed to nontoxic titanium alloy with extra-low modulus and superelasticity. (A precise numeric range for "extra-low" modulus and "superelasticity" is difficult to provide because they can vary with the chemical composition. The ranges for "extra-low" modulus is around 40 to 80 GPa and for "superelasticity" is around 1.5 to 5%.

It is submitted that neither the problem nor its solution is taught by the references relied upon. Both references are directed to "Gum Metals".

Saito et al. teach Ti/Nb/Zr, Ti/Nb/Zr/Sn, and Ti/Nb/Zr/Al. See test sample Nos. 18, 33 and 37 and Tables 2-4. There is no teaching of Ti/Nb/Zr/Sn/Al. There is also no teaching of the ranges of amounts of Nb and Zr as claimed. The actual amounts of Nb taught by Saito et al. are excluded from the instant claims. Saito et al. teach a range of 30-60 %. See, e.g. claim1, col. 3, starting at line 59 and col. 5, starting at line 45. Saito et al. specifically states that values of elements of the Va group, e.g. Nb, less than thirty percent are undesired. See col.4 starting at line 7. It is submitted that the "properties" taught by Saito et al. would be understood to be specific to the metals listed and their % WT ranges. An admonition that Nb values less than thirty percent and greater that sixty are not desired would be understood as an upper and lower threshold. A loss of properties would be expected if one chose values outside the taught range.

Hwang et al. teach do teach Ti/Nb/Zr. There is no clear teaching of Ti/Nb/Zr/Sn, Ti/Nb/Zr/Al and Ti/Nb/Zr/Sn/Al. See Table 1. There is also no teaching of the relative amounts of Nb and Zr. See Table 1. The claimed ranges are not taught. The actual amounts of Nb taught by Hwang et al. are excluded by the amended claims. Hwang et al. teach a range of 30-60 %. See, e.g. claim1, and paragraph [0026]. Hwang et al. specifically states that values less than thirty percent of elements of the Va group, e.g. Nb, are not desired. See paragraph [0064].

It is submitted that the "properties" taught by Hwang et al. would be understood to be specific to the alloy having the metals listed and their % WT ranges. A statement that Nb values less than thirty percent and greater that sixty are not desired would be understood as an upper and lower threshold relative to the taught desired properties. A loss of these properties would have been expect if values outside the taught ranges were selected.

The Examiner's position appears to be the original claimed upper threshold value was sufficiently close to the lower reference taught threshold of 30 weight percentage value that one would have expected the reference taught characteristics. The Examiner cites Titanium Metals v. Banner, 227 USPQ 773 (Fed. Cir. 1985) in support of the position taken. Claim 1 has been amended to recite an even lower upper threshold value. (New claim 29 sets forth an even lower upper limit..) There is now a very clear line of demarcation.

Further, it is submitted that under the circumstances, that there would not be an expectation that the properties of the references would not change if one chose values outside the clearly taught critical range. Both references teach the same critical range. Both references teach a unique Gum Metal alloy, which has "unconventional" properties, due to its unique composition.

As to Ti-TM (transition metal) binary titanium alloys, previous investigations have clearly shown that brittle omega phase forms in the alloys where TM ranges between 4.12 and 4.20 as characterized by electron atom ratio (the corresponding weight percent group V element Nb would be 20 to 30).[2] Previous developed beta type titanium alloys would be expected to have an electron atom ratio larger than 4.20 for ternary, quaternary and quinary alloys. The recently

[2] See, for example, Williams et al., "The Effect of Omega Phase on the Mechanical properties of Titanium Alloys", Metallurgical and Material Transaction, Vol. 2, No. 7, (July 1971) 1913-19; Sargent et al., Omega phase formation in RMI (38-6-44) beta titanium alloy", J. Materials Science 9 (1974) 487-450; and Sukedai et al., "Beta to Omega Phase Transformation in a Ti-Mo Alloy Deformed in an Impact Compression Mode Due to Aging", Microsc. Microanal. 8 (Suppl 2)

developed titanium alloys of the references ,Gum Metals, follow the rule with regard to the electron atom ratio 4.24. This corresponds to Nb contents of 36 Wt % for Ti-Nb based alloys.

Applicants found the brittle omega phase in Ti-Nb for Nb contents of 20-30 wt % can be depressed by the addition of Zr, in particular both Zr and Sn. This finding is not evident in the references. Applicants also found that alpha double prime martensite effects could be suppressed by additions by low amounts of beta stabilizer Nb from 20 and 30 wt %. This too is not evident from the teachings of the references.

Accordingly, in light of the amendment to the claims and the arguments above, it is clear a prima facie case has not been established. Withdrawal of the rejections as based on Saito et al or Hwang et al. respectively, is respectfully requested.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding rejections or objections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

If any fees are due in connection with the filing of this Amendment, such as fees under 37 C.F.R. §§1.16 or 1.17, please charge the fees to Deposit Account 02-4300; Order No. 033792R005.

Respectfully submitted,

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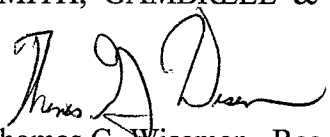

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